

RECEIVED
CENTRAL FAX CENTER

Docket No. 520.45750X00

Serial No. 10/562,643

AUG 18 2008

Office Action dated March 17, 2008

AMENDMENTS TO THE CLAIMS

The following listing of claims replaces all prior listings, and all prior versions, of claims in the application.

LISTING OF CLAIMS:

1. (Currently Amended) A magnetic resonance imaging system comprising:
 - ~~means for generating which generates a static magnetic field;~~
 - ~~gradient magnetic field generating means which generates for generating a~~
gradient magnetic field;
 - ~~RF magnetic field generating means which generates for generating an RF~~
magnetic field;
 - ~~measuring means which measures for measuring a magnetic resonance~~
signal generated from a target;
 - ~~computing means which performs configured to perform a computation on the~~
magnetic resonance signal;
 - ~~memory means which stores for storing the magnetic resonance signal and~~
the result of computation by the computing means; and
 - ~~sequence control means which sets configured to set operating conditions to~~
respective portions of the gradient magnetic field generating means, the RF
magnetic field generating means, the measuring means, the computing means and
the memory means; ~~to control the operations of the respective portions,~~
 - ~~wherein the sequence control means includes control to irradiate the target~~
~~with the RF magnetic field at least once, measure the magnetic resonance signal~~
~~generated after the irradiation of the RF magnetic field in a state in which the~~
~~strength of application of the gradient magnetic field is approximately zero, and~~
~~calculate magnetic resonance spectrum information from the measured magnetic~~

Docket No. 520.45750X00
Serial No. 10/562,643
Office Action dated March 17, 2008

~~resonance signal to thereby perform a magnetic resonance spectrum measurement;~~
and

~~wherein the sequence control means performs control~~

said sequence control means being configured to:

_____ (1) ~~to~~ measure a first magnetic resonance signal generated from a measurement voxel at the magnetic resonance spectrum measurement at a first time interval,

_____ (2) ~~to~~ detect a magnetic resonant frequency F1 of water from a first magnetic resonance spectrum obtained by Fourier-transforming the first magnetic resonance signal,

_____ (3) ~~to~~ measure a second magnetic resonance signal generated from the voxel at a second time interval subsequent to the elapse of a predetermined time from the measurement of the first magnetic resonance signal,

_____ (4) ~~to~~ detect a magnetic resonant frequency F2 of water from a second magnetic resonance spectrum obtained by Fourier-transforming the second magnetic resonance signal, and

_____ (5) ~~to~~ calculate a time-varying rate of the magnetic resonant frequency of water ~~on the basis of the~~ based on the detected F1 and detected F2,

_____ (6) ~~set, based on the calculated time-varying rate of the magnetic resonant frequency of water, a transmission frequency of the RF magnetic field radiated into the target or/and a received frequency, and~~

_____ (7) measure a magnetic resonance signal a predetermined number of times using the set transmission frequency of the RF magnetic field and/or the set received frequency.

Docket No. 520.45750X00
Serial No. 10/562,643
Office Action dated March 17, 2008

2. (Currently Amended) A magnetic resonance imaging system comprising:

means for generating ~~which generates~~ a static magnetic field;

gradient magnetic field generating means ~~which generates~~ for generating a gradient magnetic field;

RF magnetic field generating means ~~which generates~~ for generating an RF magnetic field;

measuring means ~~which measures~~ for measuring a magnetic resonance signal generated from a target;

computing means ~~which performs~~ configured to perform a computation on the magnetic resonance signal;

memory means ~~which stores~~ for storing the magnetic resonance signal and the result of computation by the computing means; and

sequence control means ~~which sets~~ configured to set operating conditions to respective portions of the gradient magnetic field generating means, the RF magnetic field generating means, the measuring means, the computing means and the memory means to control the operations of the respective portions,

~~wherein the sequence control means includes control to irradiate the target with the RF magnetic field at least once, measure the magnetic resonance signal generated after the irradiation of the RF magnetic field in a state in which the strength of application of the gradient magnetic field is approximately zero, and calculate magnetic resonance spectrum information from the measured magnetic resonance signal to thereby perform a magnetic resonance spectrum measurement;~~
and

said wherein the sequence control means performs control being configured
to:

Docket No. 520.45750X00
Serial No. 10/562,643
Office Action dated March 17, 2008

_____ (1) ~~to~~ measure a first magnetic resonance signal generated from a measurement voxel at the magnetic resonance spectrum measurement at a first time interval,

_____ (2) ~~to~~ detect a magnetic resonant frequency F1 of water from a first magnetic resonance spectrum obtained by Fourier-transforming the first magnetic resonance signal,

_____ (3) ~~to~~ measure a second magnetic resonance signal generated from the voxel at a second time interval subsequent to the elapse of a predetermined time from the measurement of the first magnetic resonance signal,

_____ (4) ~~to~~ detect a magnetic resonant frequency F2 of water from a second magnetic resonance spectrum obtained by Fourier-transforming the second magnetic resonance signal,

_____ (5) ~~to~~ estimate, based on the detected F1 and detected F2, a time-varying rate of a magnetic resonant frequency of water at a measurement time at which the magnetic resonance signal is measured after the completion of measurement of the second magnetic resonance signal,

_____ (6) ~~to~~ calculate, using the estimated time-varying rate of the magnetic resonant frequency, a transmission frequency of the RF magnetic field or/and a received frequency at which the magnetic resonance signal generated from the voxel is ~~received~~ received, and

_____ (7) measure the magnetic resonance signal generated from the voxel a predetermined number of times using the calculated transmission frequency of the RF magnetic field and/or the calculated received frequency. ~~measure the magnetic resonance signal generated from the voxel after the setting of the operating~~

Docket No. 520.45750X00
 Serial No. 10/562,643
Office Action dated March 17, 2008

~~conditions of the RF magnetic field generating means or/and the measuring means;~~
 and

~~(7) to perform said (6) repeatedly plural times subsequently to the completion
 of measurement of the second magnetic resonance signal.~~

3. (Cancelled)

4. (Currently Amended) A magnetic resonance imaging system comprising:

means for generating which generates a static magnetic field;

gradient magnetic field generating means which generates for generating a
 gradient magnetic field;

RF magnetic field generating means which generates for generating an RF
 magnetic field;

measuring means which measures for measuring a magnetic resonance
 signal generated from a target;

computing means which performs configured to perform a computation on the
 magnetic resonance signal;

memory means which stores for storing the magnetic resonance signal and
 the result of computation by the computing means; and

sequence control means which sets configured for setting operating
 conditions to respective portions of the gradient magnetic field generating means,
 the RF magnetic field generating means, the measuring means, the computing
 means, and the memory means; ~~to control the operations of the respective portions;~~

Docket No. 520.45750X00
 Serial No. 10/562,643
Office Action dated March 17, 2008

said sequence control means wherein the sequence control means performs,
~~when the measurement of the magnetic resonance signal is performed repeatedly~~
~~plural times, control being configured to:~~

_____ (1) to execute one or more pre-scans ~~a pre-scan~~ for measuring a
 magnetic resonant frequency of water ~~each time the magnetic resonance signal is~~
~~measured a predetermined number of times,~~

_____ (2) to detect a magnetic resonant frequency of water from a magnetic
 resonance spectrum obtained by Fourier-transforming the magnetic resonance
 signal obtained by ~~the~~ a current pre-scan, and

_____ (3) to set, based on the magnetic resonant frequency of water detected
 in said (2), a transmission frequency of the RF magnetic field radiated into the target
 or/and a received frequency, ~~and at the measurement of the magnetic resonance~~
~~signal in a pulse sequence executed subsequently to the pre-scan~~

_____ (4) measure the magnetic resonance signal a predetermined number of
times for each of the one or more pre-scans using the set transmission frequency of
the RF magnetic field and/or the set received frequency.

5. (Currently Amended) A magnetic resonance imaging system comprising:

means for generating ~~which generates~~ a static magnetic field;

gradient magnetic field generating means ~~which generates~~ for generating a
 gradient magnetic field;

RF magnetic field generating means ~~which generates~~ for generating an RF
 magnetic field;

measuring means ~~which measures~~ for measuring a magnetic resonance
 signal generated from a target;

Docket No. 520.45750X00
 Serial No. 10/562,643
Office Action dated March 17, 2008

computing means ~~which performs~~ configured to perform a computation on the magnetic resonance signal;

memory means ~~which stores~~ for storing the magnetic resonance signal and the result of computation by the computing means; and

sequence control means ~~which sets~~ configured to set operating conditions to respective portions of the gradient magnetic field generating means, the RF magnetic field generating means, the measuring means, the computing means and the memory means ~~to control the operations of the respective portions,~~

said sequence control means being configured to:

(1) execute one or more pre-scan sequences for measuring a magnetic resonant frequency of water,

(2) set, based on the measured magnetic resonant frequency of water, a transmission frequency of the RF magnetic field irradiated in a water suppression sequence and a transmission frequency of the RF magnetic field irradiated to select and excite a predetermined voxel or/and a received frequency at a detection of a magnetic resonance signal generated from the predetermined voxel in a spectrum measurement sequence,

~~wherein the sequence control means performs control (1) to~~

(3) execute a ~~the~~ water suppression sequence for applying the RF magnetic field and the gradient magnetic field to the target to thereby suppress a signal of water, ~~(2) to and~~

(4) execute a ~~the~~ spectrum measurement sequence for applying the RF magnetic field and the gradient magnetic field to the target to select and excite a predetermined voxel and measuring the magnetic resonance signal generated from the predetermined voxel, ~~(3) to execute a pre-scan sequence for measuring a~~

Docket No. 520.45750X00
Serial No. 10/562,643
Office Action dated March 17, 2008

~~magnetic resonant frequency of water prior to said (1) and (2) being executed a predetermined number of times, where said (1) and (2) are performed repeatedly plural times, and (4) to, on the basis of the magnetic resonant frequency of water detected in said (3), set a transmission frequency of the RF magnetic field irradiated in the water suppression sequence and set a transmission frequency of the RF magnetic field irradiated to select and excite the predetermined voxel or/and a received frequency at the detection of the magnetic resonance signal generated from the predetermined voxel in the spectrum measurement sequence~~

wherein the water suppression sequence and the spectrum measurement sequence are executed a predetermined number of times for each of the one or more pre-scan sequences.

6. (Currently Amended) A magnetic resonance imaging system comprising:

~~means for generating which generates a static magnetic field;~~

~~gradient magnetic field generating means which generates for generating a gradient magnetic field;~~

~~RF magnetic field generating means which generates for generating an RF magnetic field;~~

~~measuring means which measures for measuring a magnetic resonance signal generated from a target;~~

~~computing means which performs configured to perform a computation on the magnetic resonance signal;~~

~~memory means which stores for storing the magnetic resonance signal and the result of computation by the computing means; and~~

Docket No. 520.45750X00
Serial No. 10/562,643
Office Action dated March 17, 2008

sequence control means ~~which sets~~ configured to set operating conditions to respective portions of the gradient magnetic field generating means, the RF magnetic field generating means, the measuring means, the computing means and the memory ~~means to control the operations of the respective portions,~~ means,

said sequence control means being configured to: ~~wherein the sequence control means performs control~~

_____ (1) ~~to execute~~ a water suppression sequence for applying the RF magnetic field and the gradient magnetic field to the target to thereby suppress a signal of water,

_____ (2) ~~to execute~~ a spectrum measurement sequence for applying the RF magnetic field and the gradient magnetic field to the target to select and excite a predetermined voxel and measuring the magnetic resonance signal generated from the predetermined voxel,

_____ (3) executed the water suppression sequence and the spectrum measurement sequence a predetermined number of times to, ~~when said (1) and (2) are performed repeatedly plural times, to~~ detect a water signal peak from a magnetic resonance spectrum obtained by Fourier-transforming the measured magnetic resonance signal, and obtained by the execution of said (1) and (2), ~~each time said (1) and (2) are executed a predetermined number of times to~~ calculate a signal strength of the water signal peak,

_____ (4) ~~to determine~~ that a magnetic resonant frequency of water has been shifted when the calculated signal strength of the water signal peak is increased to a predetermined value or more,

Docket No. 520.45750X00
Serial No. 10/562,643
Office Action dated March 17, 2008

_____ (5) ~~to execute~~ a pre-scan for measuring the water magnetic resonant frequency when the water magnetic resonant frequency is judged to have been shifted in said (4),

_____ (6) ~~to detect~~ a magnetic resonant frequency of water from a magnetic resonance spectrum obtained by Fourier-transforming the magnetic resonance signal obtained in the pre-scan, and

_____ (7) set, based on the detected ~~to, in a pulse sequence executed subsequently to the pre-scan on the basis of the magnetic resonant frequency of water detected in said (6),~~ set a transmission frequency of the RF magnetic field irradiated in ~~the~~ a further water suppression sequence, or/and set a transmission frequency of the RF magnetic field irradiated to select and excite the predetermined voxel in ~~the~~ a further spectrum measurement sequence, or/and set a received frequency at the detection of the magnetic resonance signal generated from the predetermined voxel,

wherein the further water suppression sequence and the further spectrum measurement sequence are executed subsequent to the pre-scan.